0032 AAALAC international agricultural animal research program accreditation at Purdue University: "The good, the bad, and the ugly." J. S. Radcliffe*, *Purdue University, West Lafayette, IN.*

Admittedly, most production animal researchers at Purdue where scared when Purdue decided to move forward with AAALAC International Agricultural Animal Research Program accreditation. Two main concerns dominated: (1) How would AAALAC deal with the unique issues of animals in a production setting versus a laboratory setting? And (2) Would AAALAC accreditation interfere with our research? Particular emphasis was placed on cost of accreditation in terms of making or keeping programs compliant, facility maintenance, enhanced workload on researchers, and the possibility of excessive or "unnecessary" oversight. As we navigated through the accreditation process, we found that expense was manageable and, that if the program was well run, already it easily fit within the AAALAC guidelines and, if improvements were needed, it helped to have the need for accreditation as the reason to force the necessary improvements. We also found that AAALAC itself was willing to have open discussions about issues specific to production animal research and work with Purdue to create solutions to any issues. Today, AAALAC accreditation and maintenance of our accreditation status allows Purdue to promote and advertise our high standards for research and animal care across all species, demonstrate our commitment to public accountability, lobby the university for continuous improvement, and market our accreditation to federal and industry funding sources.

Key Words: AAALAC accreditation, Purdue, welfare

ADSA PRODUCTION DIVISION SYMPOSIUM: ROBOTIC DAIRYING: ADAPTING FARM AND BUSINESS MANAGEMENT

0033 Changes in dairy farm management strategies with the adoption of robotic milking. J. Rodenburg*, *DairyLogix, Woodstock, ON, Canada.*

Adoption of robotic milking on dairies of up to 250 cows is improving the lifestyle of dairy families, and it is an effective way to reduce labor in herds of all sizes. Since milking is voluntary, and feed delivered during milking is the main enticer for attendance, feeding strategies that offer palatable pelleted concentrate in the milking stations, combined with low starch mixed feeds or forage at the feed fence, improve milking frequency and production. Barn layouts that encourage low-stress access by providing adequate open space near the milking stations and escape routes for waiting cows also improve milking frequency and reduce the number of cows requiring fetching. Lame cows present themselves less often for milking and produce less milk. Preventing lameness with comfortable stalls, clean alley floors, and effective foot bathing and treatment protocols is given greater emphasis on robotic dairies. Variable milking times create challenges for foot bathing, sorting and handling, and dealing with special-needs cows. These challenges must be addressed with appropriate cow routing and separation options at the milking stations, if the expected labor savings are to be realized. With less work, all protocols and the layout and gating of the barn should make it possible to complete handling tasks alone. Unattended milking demands reliance on sensors to monitor health and performance; but this, along with computer control of milking intervals and feeding levels, creates new opportunities to manage cows individually. Much of the potential to improve the productivity, health, and longevity of dairy cows, and to decrease feed costs through combining the use of sensor data with individual feeding and milking, is as yet unrealized. Free traffic and guided traffic systems have been adopted, and results are similar when excellent management is applied. In less-ideal circumstances, guided traffic and the use of commitment pens results in long standing times and stress, particularly for lower-ranking cows, while poor management with free traffic results in more labor for fetching nonattending cows. Robotic dairies require a smaller labor force than conventional dairies, but function best with skilled workers than can perform a variety of tasks.

Key Words: automatic milking, robotic milking

0034 Opportunities and challenges for herd health and reproduction with robotic milking. S. J. LeBlanc*, *Department of Population Medicine, Ontario Veterinary College, University of Guelph, Guelph, ON, Canada.*

There has been a rapid increase in the number of herds with automatic milking systems (AMS). This technology is a well-established means to harvest milk from cows. Robotic milking offers potential advantages in labor per cow, increased milking frequency, and integration of sensors and data collection that assist with estrus detection, and might help with detection of health problems or lameness. Activity monitoring (AM) systems (in AMS or parlor-milked freestall barns) have been shown to produce, on average, comparable herd pregnancy rates to alternative approaches to reproductive management. However, AM requires supplemental interventions for timely AI for approximately 20% of inseminations. AMS provide streams of a variety of data on activity, milking frequency and timing, quarter-level milk yield, and conductivity, and the daily cow-level variation in these metrics. The systematic collection of these data offers the promise of detection of some health problems earlier and with less variation. However, selection of valid, actionable indicators of health from

AMS data remains a work in progress, and a balancing act of adequate detection and false alerts. As with conventional systems, the associations of AMS with cow health, welfare, and performance are confounded by their human managers. There is little data on measures of health with AMS. More research is needed on the predictive value of indicators of mastitis from AMS. Research on approaches to and outcomes of treatment of mastitis with AMS-based detection is lacking. Reports indicate a similar prevalence of lameness to non-AMS freestall barns, with similar stall- and bedding-related factors associated with lameness, injuries, and lying time. Processing of multiple data inputs, mostly related to cow activity and milking performance, has been shown to have reasonable accuracy for detection of lameness, which if successfully implemented, would likely be earlier and more thorough. Preliminary data indicate a higher prevalence of ketosis in herds with AMS. Feeding behavior is generally driven by feed delivery as in non-AMS barns, such that feeding space requirements are similar. Timely detection of metabolic disease such as ketosis may be aided but not replaced by AMS-derived data, and detection of reproductive disease still requires daily observation of the cows by skilled people; pen design and cow handling equipment are needed to facilitate interactions with the cows.

Key Words: health, disease detection, precision technology

0035 Nutritional approaches in robotic herds.
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Cows in herds equipped with conventional milking parlor systems follow a structured, consistent, and social milking and feeding routine. Furthermore, in most cases, cows in these systems receive all their nutrients from a TMR, whereas in herds equipped with robotic or automatic milking systems (AMS), cows receive a fraction of their nutrients during milking, mainly as a means to attract them to the milking system. In this regards, the AMS presents both a challenge and an opportunity for feeding cows. The main challenge resides in maintaining a minimum and relatively constant milking frequency in AMS. Hover, milking frequency is dependent on many factors, including the social structure of the herd, the farm layout design, the type of traffic imposed to cows, the type of flooring, the health status of the cow (especially lameness, but also mastitis, metritis, etc.), the stage of lactation, the parity, and the type of ration fed at the feed bunk and the concentrate offered in the AMS. Uneven milk frequency has been associated with milk losses and increased risk of mastitis, but most importantly, with a lost opportunity for milking the cow. On the other hand, the opportunity from AMS resides in the possibility of milking more frequently, and feeding cows more precisely or closely to their nutrient needs (in an individual basis), potentially resulting in a more profitable production system. However, feeding cows in the parlor or AMS has many challenges by itself. On one side, feeding starchy, high-palatable ingredients, may upset rumen fermentation or alter feeding behavior after milking, and feeding high-fiber concentrates may compromise total energy intake and ultimately milking performance. Nevertheless, AMS (and some milking parlors, especially rotary ones) offer the possibility of feeding the cows to their estimated individual nutrient needs with the aim of maximizing profits (rather than milk yield). This approach requires that not only the amount of feed offered, but also the composition of the feed for each individual cow need to change according to the nutrient needs. The change in composition can be achieved by combining several feed ingredients or concentrates on real-time as the cow enter the AMS (or the milking parlor). This review discusses the opportunities and pitfalls of milking and feeding cows in an AMS and summarizes different feeding strategies to maximize profits by managing the nutrition of the cows individually.

Key Words: modeling, precision feeding, optimization

0036 Finances and returns for robotic dairies.
J. A. Salfer[*1], M. I. Endres[2], W. Lazarus[2], and K. Minegishi[2], [1]*University of Minnesota, St. Cloud,* [2]*University of Minnesota, St. Paul.*

Automatic or robotic milking systems (AMS) are being adopted by dairy producers at a relatively fast rate. Previous studies of the economic returns of AMS compared with parlor milking systems (PMS) are scarce and offer mixed results mostly because of the assumptions used by the researchers. The key parameters that affected these results pertained to the costs and economic life of AMS, and the prospect of the AMS to increase milk production and decrease labor. Another key factor affecting profitability of AMS is milk production per AMS milking unit. Increasing average milk flow rate and reducing milking preparation time, along with increasing the percentage of milking box occupation time, has been shown to increase milk production per AMS unit. The nonfinancial lifestyle improvement factor is another consideration that influences the decision to install an AMS. We developed a simulation model to compare the economics of alternative milking systems under current Minnesota conditions. As an example, for a 120-cow operation currently switch milking in a tiestall barn, the most profitable alternative is to build a new freestall barn and install a retrofit PMS (double 8) in the old building. A new PMS is slightly less profitable because of the higher cost of investment. Another factor affecting profitability in our model is how much money is spent on the freestall barn. Many AMS freestall barns constructed in cold climates are warm barns and have expensive manure handling systems (slatted floors or automatic scrapers). An AMS is less profitable than a PMS under those circumstances, if milking and chore labor is valued at $15/h. It would require a labor rate of around $50/hour to make the AMS and PMS equally profitable. Including inflation in labor rate also increases the

profitability of AMS systems compared with PMS because of the labor saved. If the barn is equipped more like a typical parlor operation, an AMS may be similar to a PMS in profitability. Those results assume a labor reduction and a milk production increase with the AMS compared with the PMS. Surveys have shown that most farmers are happy with the decision to install AMS. Much of the satisfaction is not based on economic returns, but on improved lifestyle. Maximizing milk per robot by optimizing cow numbers and milking speed, along with improved labor efficiency and increased milk production per cow, will maximize dairy farm returns.

Key Words: automatic milking systems, profitability

ADSA-SAD (STUDENT AFFILIATE DIVISION) UNDERGRADUATE STUDENT ORAL COMPETITION: DAIRY FOODS

0037 Milk is milk, isn't it? J. M. Madigan* and S. P. Washburn, *North Carolina State University, Raleigh.*

This paper examines the differences in beverages from almonds or soybeans compared with milk from cows. There are some people that argue plant-based beverages hold the same nutritional aspects as milk and are overall better for the consumer. Through examination of multiple research papers on cow-based milk and plant-based "milk" products, discussion and analysis of potential benefits and limitations of each product is examined. One key point of analysis is that soymilk was shown to reduce cholesterol (Meyer et al., 2004), but in another study showed no effect even with increased isoflavone in samples taken (Onuegbu et al., 2011). Almond milk seemed to cause hyperoxaluria and genitourinary disorders in children due to richness in oxalate, though showed to be a good option for lactose intolerant individuals (Ellis and Lieb, 2015). Though almond based beverages can be an alternative for lactose intolerant people, NC State University's Department of Food, Bioprocessing, and Nutrition discovered that the use of *Lactobacillus acidophilus* bacteria can help make milk acceptable to lactose intolerant individuals (Sanders and Klaenhammer, 2001). A study also showed that people who consumed cow milk more than once a day had a lower likelihood to have type 2 diabetes (Morcillo et al., 2012). A key nutrient, protein, was shown to be lacking in almond milk, which has less than 1 g per cup vs. 2% milk with 8 g per cup (USDA). Milk is also a better source for essential fatty acids than either soymilk or almond milk (USDA, nutritiondata.self.com). From the data collected over multiple studies and databases, a conclusion is reached that, though plant based "milk" products such as beverages made from almonds and soybeans have some nutritional promise, they have a difficult time replacing milk from a cow.

Key Words: milk, milk substitutes, nutrition

0038 Health benefits of *Lactobacillus helveticus* in dairy foods. C. Kenny*, *Louisiana State University, Baton Rouge.*

Lactic acid bacteria (LAB) are often used as a starter culture in the production of cheeses. These LAB produce biopeptides by breaking down proteins in milk that have positive effects on the functions of the body. One specific LAB, *Lactobacillus helveticus,* which is used in the production of many Italian cheeses such as Swiss, Provolone, Mozzarella, and Parmesan, has many extremely valuable health benefits. *Lactobacillus helveticus* is able to survive after being eaten, and adheres to epithelial cells in the gastrointestinal tract. Because of this, *L. helveticus* can stimulate the digestive tract and reduce lactose intolerance, and inhibit the absorption of some pathogens while also increasing the absorption of certain nutrients. However, the two most valuable benefits of *L. helveticus* are its nontumorogenic and nonhypertensive properties. *Lactobacillus helveticus* has been shown in research studies to inhibit the growth of colon cancer cells and breast cancer cells in vivo. Because of these studies, *L. helveticus* is being considered to be a potential anticancer treatment. Further, *L. helveticus* is an angiotensin converting enzyme (ACE) Inhibitor, meaning that it prevents the release of Angiotensin II, which constricts blood vessels. This keeps blood vessels and the heart healthy, which prevents high blood pressure. From all angles of human health, *L. helveticus* has many benefits when consumed.

Key Words: lactic acid bacteria, cheese, health benefits

0039 A2 milk marketing and human health. J. Nystrom* and D. R. Winston, *Virginia Tech, Blacksburg.*

Although butter and cheese sales have been increasing over recent years, fluid milk sales have been declining in the United States since 1970. With declines in per capita milk consumption, and changes in the export market, the dairy industry has to be creative in developing products to increase milk sales. Recent products like Fairlife® ultra-filtered milk is an example of an innovative fluid milk product that demonstrates adaptability of the dairy industry to consumer preferences. In the U.K., Australia, New Zealand, and recently, California, A2 milk has been introduced as a functional dairy food. A2 milk contains a homozygous A2 β-casein protein, whereas conventional milk contains a heterozygous combination of A1 and A2 β-casein proteins. While A2 milk has been available in U.K. since 2012 and previously in New Zealand and Australia, it has just recently made its way to the U.S. markets. Research on digestibility of A2 milk is ongoing; however, the A2 Milk Company is a processor that only sells 100% A2 milk in New Zealand and also exports to the U.K., China, the United States, and Australia. In the first human trial of A2 versus A1 milk digestion, conducted by Ho et al., A2 and A1 milk was significantly higher in digestibility than A1 milk. Almost all cows have the A2 gene, but the majority have an A1/A2 combination. The